AEROLOGICAL OBSERVATIONS

[The Aerological Division, W. R. GREGG in Charge]

By L. T. SAMUELS

Table 1 contains data for only three stations, aerological observations having been discontinued at Broken Arrow, Okla., and Groesbeck, Tex. It will be noted that free-air temperatures were above normal at the two northern stations, viz., Ellendale and Royal Center, and below normal at Due West. The positive departures increased with altitude, being greatest between 2,000 and 3,000 meters elevation.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during June, 1931*

TEMPERATURE (°C.)

Altitude (meters) m. s. l.	Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	24.5	−0.9	21.4	+2.7	23.0	+1.2
500	21.8	−0.7	21.0	+2.7	21.4	+2.5
1,000	19.6	+0.2	19.4	+4.1	19.5	+3.9
1,500	16.0	0.0	17.8	+5.1	16.6	+3.8
2,000	12.5	−0.2	15.1	+5.3	14.0	+3.8
2,500	9.1	−0.5	11.8	+4.9	11.6	+4.1
3,000	5.6	−0.9	8.4	+4.3	8.9	+4.1
4,000	−2.4	−2.3	2.2	+3.8	2.7	+2.9
5,000	−8.4	−2.3	−4.1	+3.4	−3.1	+3.6

RELATIVE HUMIDITY (%)

Surface	63	−2	66	−4	71	+5
500	65	−2	65	−4	69	+1
1,000	60	−7	55	−12	65	−4
1,500	63	−6	51	−13	65	−2
2,000	64	−6	50	−12	64	+2
2,500	62	−8	52	−9	62	+6
3,000	61	−7	54	−3	61	+9
4,000	60	0	55	+5	62	+21
5,000	55	0	61	+11	53	+2

VAPOR PRESSURE (*mb.*)

Surface	19.74	−0.86	16.82	+1.53	20.54	+3.22
500	17.22	−0.83	16.30	+1.48	17.96	+3.08
1,000	13.98	−0.99	12.20	+0.47	14.96	+2.47
1,500	11.73	−0.81	10.05	+0.62	12.78	+2.51
2,000	9.47	−0.71	8.41	+0.81	10.74	+2.84
2,500	7.21	−0.99	7.17	+0.91	8.86	+3.10
3,000	5.65	−0.77	6.11	+1.28	7.39	+3.10
4,000	3.25	−0.28	4.14	+1.03	5.39	+3.21
5,000	2.32	−0.28	2.76	+0.40	3.60	+1.87

The relative humidity departures were mostly small and negative except at Royal Center, where positive departures occurred with positive temperature departures. This condition is evidently significant in connection with the large amount of precipitation for the month at Royal Center, viz., 8.97 inches, which exceeded all previous amounts for June since the establishment of the station in 1918.

Vapor pressure departures were of the same sign as those for temperature, with the largest departures occurring at Royal Center.

Conspicuous in Table 2 is the low relative humidity at 2,000 and 3,000 meters at San Diego as compared with the other stations. This condition is characteristic of the southwestern part of the country and is probably a consequence of air originating over Mexico.

A noticeable feature of Table 3 is the southwesterly component in the free-air resultant winds over the western part of the country as compared with the northwesterly component over the eastern section.

TABLE 2.—*Free-air data obtained by airplanes at naval air stations during June, 1931*

Altitude (meters) m. s. l.	Temperature (°C.)				Relative humidity (%)			
	Hampton Roads, Va.	Pensacola, Florida	San Diego, Calif.	Washington, D. C.	Hampton Roads, Va.	Pensacola, Florida	San Diego Calif.	Washington, D. C.
Surface	22.1	24.3	21.4	21.3	71	82	65	67
500	18.7	22.8	17.7	19.8	66	71	72	58
1,000	16.1	20.2	16.5	17.6	62	62	62	59
2,000	9.7	14.0	14.1	12.3	62	61	36	57
3,000	4.1	8.6	9.0	7.1	62	55	27	51
4,000				0.2				56

TABLE 3.—*Observations by means of kites, captive and limited height sounding balloons during June, 1931*

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Royal Center, Ind.
Mean altitudes (meters), M. S. L., reached during month	2,664	2,852	3,387	3,955
Maximum altitude (meters), M. S. L., reached and date	[1] 4,039	[1] 5,090	[1] 5,197	[1] 9,343
Number of flights made	[2] 7	32	30	33
Number of days on which flights were made	[2] 7	28	28	30

[1] Limited-height sounding balloon observation.
[2] Covers period from June 1 to 7, inclusive, only.

In addition to the above, there were approximately 180 pilot-balloon observations made daily at 60 Weather Bureau stations in the United States.

TABLE 4.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during June, 1931*

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,528 meters)		Brownsville, Tex. (12 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,873 meters)		Chicago, Ill. (198 meters)		Cleveland, Ohio (245 meters)		Dallas, Tex. (154 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (14 meters)		Key West, Fla. (11 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	N 31 E	0.6	S 42 E	1.5	S 5 E	1.0	N 85 W	2.5	S 4 W	1.0	S 5 W	0.9	S 32 E	2.5	W	0.2	S 20 W	0.4	S 68 W	1.4	S 47 W	0.5	N 84 E	1.8
500			S 24 E	9.2	S 75 W	1.9			S 52 W	3.7	S 53 W	1.5	S 15 W	9.0	S 79 W	2.2	S 19 W	1.2			S 76 W	2.8	S 86 E	4.5
1,000			S 18 E	7.8	N 33 W	3.7			S 89 W	5.3	N 74 W	2.2	S 18 W	7.4	N 70 W	2.4	S 47 W	4.4	S 72 W	3.2	N 81 W	2.3	S 80 E	3.4
1,500			S 19 E	5.8	N 35 W	4.8			N 86 W	6.6	N 77 W	3.5	S 24 W	4.6	N 64 W	3.1	S 67 W	4.5	N 89 W	5.8	N 35 W	1.6	S 63 E	2.6
2,000	S 30 E	1.1	S 21 E	5.1	N 27 W	6.2	S 84 W	4.5	N 78 W	6.4	N 66 W	5.4	S 22 W	3.1	N 65 W	4.3	S 63 W	3.9	S 83 W	6.0	N 6 E	2.2	S 27 E	1.6
2,500	S 49 W	2.0	S 30 E	3.7	N 33 W	8.3	S 83 W	5.4	N 76 W	5.9	N 60 W	5.0	S 16 W	2.7	N 64 W	4.3	S 68 W	4.8	S 72 W	6.3	N 11 E	2.2	S 15 E	1.6
3,000	S 78 W	3.1	S 66 E	2.7	N 32 W	8.7	N 77 W	6.2	N 87 W	6.4	N 66 W	5.1	S 15 W	1.5	N 40 W	4.5	N 84 W	5.5	S 75 W	7.3	N 20 E	1.9	S 25 E	1.0
4,000	S 71 W	4.0	S 61 E	1.4	N 42 W	9.4	N 70 W	7.8	N 51 W	11.5	N 52 W	5.8	N 58 W	0.8	N 44 W	6.6	N 84 W	8.9	S 71 W	8.2	N 29 W	2.8	S 38 W	1.1
5,000	S 33 W	3.4	N 7 E	1.8			N 83 W	7.5					N 85 E	1.5	N 36 W	5.7	N 82 W	12.0	S 82 W	10.7	N 38 W	3.6	S 65 W	1.7

TABLE 4.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during June, 1931*—Continued

Altitude (meters) m. s. l.	Los Angeles, Calif. (127 meters)		Medford, Oreg. (410 meters)		Memphis, Tenn. (145 meters)		New Orleans, La. (25 meters)		Oakland, Calif. (8 meters)		Oklahoma City, Okla. (392 meters)		Omaha, Nebr. (299 meters)		Phoenix, Ariz. (356 meters)		Salt Lake City, Utah (1,294 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Washington, D. C. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	S 84 E	0.6	N 61 W	0.4	S 6 W	1.1	N 6 E	0.3	S 78 W	1.5	S 1 W	2.9	S 32 E	2.3	N 84 E	1.2	S 22 E	2.3	S 78 E	0.8	S 39 E	1.1	N 20 W	1.0
500	S 59 E	1.2	N 79 W	0.5	S 71 W	3.2	N 71 W	0.9	N 83 W	3.1	S 13 W	6.6	S 4 W	5.4	N 88 W	0.3	----------	---	S 10 E	1.8	S 13 W	2.5	N 46 W	3.8
1,000	N 46 W	0.9	N 88 W	1.0	S 85 W	3.8	S 36 E	1.5	N 63 W	5.3	S 33 W	10.8	S 44 W	9.0	S 60 W	1.9	----------	---	S 56 W	3.4	S 29 W	3.2	N 44 W	4.6
1,500	N 53 W	2.1	S 31 W	1.0	S 74 W	4.0	S 40 E	2.0	N 52 W	4.1	S 40 W	8.5	S 50 W	7.9	S 5 W	1.2	S 13 E	5.2	S 74 W	3.0	S 42 W	3.9	N 52 W	5.8
2,000	S 83 W	2.4	S 33 W	1.8	S 79 W	4.6	S 70 E	1.8	N 77 W	4.6	S 41 W	6.5	S 57 W	6.0	S 9 E	3.0	S 4 W	5.8	S 86 W	3.6	S 41 W	4.6	N 56 W	6.6
2,500	S 19 W	2.7	S 51 W	4.2	S 59 W	4.7	S 76 E	1.4	N 88 W	4.1	S 54 W	3.8	S 51 W	6.2	S 1 W	4.8	S 30 W	6.5	N 82 W	4.6	S 41 W	3.6	N 54 W	6.9
3,000	S 18 W	3.4	S 48 W	6.0	S 47 W	3.7	S 74 E	1.2	S 78 W	4.7	S 58 W	2.8	S 49 W	4.8	S 16 W	6.4	S 48 W	6.5	N 81 W	6.5	S 14 W	4.6	N 50 W	7.3
4,000	----------	---	S 53 W	6.8	----------	---	N 12 E	1.9	----------	---	N 55 W	1.2	S 71 W	3.9	S 29 W	7.5	S 45 W	6.9	N 83 W	9.2	----------	---	N 22 W	9.5
5,000	----------	---	----------	---	----------	---	N 86 W	0.9	----------	---	----------	---	N 63 W	5.6	S 18 W	6.6	S 54 W	11.4	N 65 W	15.4	----------	---	----------	---

WEATHER IN THE UNITED STATES

[Climatological Division, Oliver L. Fassig in Charge]

THE WEATHER ELEMENTS

By M. C. BENNETT

GENERAL SUMMARY

June as a whole was abnormally warm in the interior and Northwestern States, while moderate temperatures prevailed in much of the South and Atlantic areas. From Oklahoma, Missouri, and Illinois northward and northwestward the monthly mean temperature averaged from 5° to 9° above the normal, the last week being abnormally warm, with the highest weekly mean temperatures of record for June over large areas. The month was likewise abnormally warm along the south Pacific coast, while generally moderate temperatures for the season prevailed in the north Pacific districts.

The precipitation for the month was rather unevenly distributed, with less than the normal over large areas. The Northeast, much of the Lake region, southern Texas, and the Rio Grande Valley received generous to heavy rainfall for the season, and more than normal was received in much of the Pacific region from central California northward. Elsewhere the precipitation was below normal, especially in portions of the Southeast and Northwest. From 10 to 25 per cent of normal was recorded in northern Alabama and Georgia, eastern Tennessee, and portions of the Carolinas, while in portions of southern Idaho only about one-tenth of the normal was received.

TEMPERATURE

From the beginning of the month until a little after the middle the temperature presented no features deserving special notice, although in the far Northwest readings were usually several degrees higher than normal, while comparatively cool weather was noted at times in several portions of the eastern half of the country. This tendency to temperatures below normal was most persistent in some parts of the Lake region and in coast districts between the Rio Grande and Chesapeake Bay.

After the 17th marked heat set in over the southern Plains and the central valleys and prevailed during the remainder of the month, generally increasing in intensity and extending until practically all States from the Rocky Mountain foothills to the Appalachians were under its sway. The Atlantic States were somewhat affected by hot weather, yet mainly were not much warmer than normal during these final two weeks of June, while some districts west of the Continental Divide were experiencing cool weather, particularly the northwesternmost States, during the last week.

The month averaged warmer than normal almost throughout the country, a few areas near Lake Ontario or along the Atlantic or Gulf coast averaging slightly cooler than normal, also much of the far Southwest and part of the State of Washington. From the northern and middle Rocky Mountains eastward to the upper Lakes and the lower Ohio Valley the month averaged at least 3° above normal, and over the northern half of the Plains from 6° to 9° above. The mean temperature was the highest of June record at numerous stations in the northern and middle Plains and the upper Mississippi Valley, while as far to southeastward as Chattanooga, Tenn., it was but slightly below the June record.

The highest marks noted during the last 10 days of June became the record temperatures for all Junes at many stations in the central part of the country.

In general, 100° was reached or passed in every State, save a few small Northeastern States, while some Central Valley States noted marks of 107° to 109°, and South Dakota, 115°. The highest mark reported anywhere in the country was 119° in Arizona. Usually the highest readings occurred during the last three days, but in parts of the upper Ohio Valley and Middle Atlantic States, also the southern Plains, about the 20th, and in the far West on various dates.

The lowest readings of June varied from 48° in several Gulf States to 16° in Oregon, the latter at a high mountain station. Except in the Pacific and northern Rocky Mountain States they usually ocurred during the first 10 days of the month.

PRECIPITATION

In the middle and northern portions of the country between the Rocky Mountains and the Mississippi River the important rains of June occurred at various times in the different States, except the closing week was mainly very dry. To eastward the weeks were about equal in the matter of rains, when the whole area is considered, save the second week which brought little, except in the Lake Superior region and close to the Atlantic coast.

The southeastern and south-central portions of the country had generally scanty rainfall compared with normal, and what occurred fell mainly during the second and third weeks, save that Oklahoma and the Carolina coast had moderate supplies during the first week and